internal differences upon which *Anopliopsis* mainly rests will be bridged so that no satisfactory line of demarcation will be found between *Anopliopsis* and *Chonetes*. This possibility is suggested by a little known species described by Stevens as *Chonetes Michiganensis*. In its external appearance *C. Michiganensis* could be called a normal species of *Chonetes* s. s. It is a large shell, it is not highly arched, and it is marked by irregular, feeble, but quite distinguishable costae. Its internal characters, however, are analogous to those of *A. subcarinata* except that the radial plates are not so high and are obviously compacted of spinules possibly through deposits of callus. Although *Anopliopsis* is endowed with strong individuality by reason of its combination of size, configuration, and sculpture, aside from its internal characters, the fact just mentioned suggests that in its internal characters it may grade into *Chonetes*.

On the other hand, the distinction between *Anopliopsis* and *Chonetina* so far as can be determined, rests mainly upon differences in configuration and sculpture emphasized by differences in time and place of occurrence. Future discoveries may bring to light species constructed like *Anopliopsis* and *Chonetina* which are intermediate in geologic time and are gradational in shape and ornamentation.

ZOOLOGY.—*A new copepod from Japanese oysters transplanted to the Pacific coast of the United States.*[1]

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A few years ago some of the large Japanese oysters were transplanted to the Pacific coast of the United States and have thriven well in their new environment. During the past year some of them have been found to be infested with a copepod and specimens have been sent to the present author for identification. These specimens included both sexes and have proved to be a new species, a description and figures of which are here presented.

Mytilicola ostreae, n. sp.

Occurrence.—The copepods are found attached to the inner wall of the stomach of the oyster. There are usually but two or three specimens on one host but as many as twenty have been taken from a single oyster, in which case a considerable portion of the stomach cavity was occupied by them.

Female.—Body elongate, narrow and tapered posteriorly; head separated from the thorax, wider than long, with a small dorsal carapace which is divided longitudinally through its center. The five thoracic segments and the genital segment completely fused, with no indication of separation except the paired dorsal processes. Each thoracic segment bears a pair of these processes near its posterior corners. Each process is triangular in shape and extends diagonally outward and backward, with an acute tip which sometimes curves slightly forward. The first four pairs of processes increase in size posteriorly, the fifth pair are smaller than the fourth. The genital seg-

Received March 2, 1938.

ment is enlarged at its posterior corners, but has no processes. The abdomen is considerably narrower and thinner than the genital segment and tapers a little posteriorly. It is as long as the genital segment and is apparently undivided with smooth lateral margins. The caudal rami are cylindrical, longer than wide and slightly divergent, and show no setae in any of the specimens examined.

The first antennae are 4-segmented, the basal segment large and swollen, the other three segments much smaller, and all four sparsely armed with small spines. The second antennae are 2-segmented, the distal segment in the form of a stout curved claw, divided at its center and each half armed with a spine-like seta. These are the organs which attach the copepod to the stomach wall of its host and keep it from being swept out by the food current of the oyster. The mandible is attached beneath the posterior corner of the upper lip and extends inward and backward. It is cylindrical, unsegmented and so minute that it does not reach inside of the first maxilla, and so can scarcely function at all. The first maxilla is an elliptical mamma, slightly raised above the surface of the head and armed with two short spine-like setae. It is situated behind the corner of the upper lip and fits into a semicircular invagination of the latter. The second maxilla is made up of a stout basal portion attached to the surface of the head and a 2-segmented portion; the end segment is curved and fringed with fine hairs. The maxilliped is lacking in the female. There are four pairs of swimming legs, each leg uniramose and reduced to a simple pointed knob visible only in profile. The ovisacs are elongate conical, tapered to a point distally and three quarters as long as the entire body. The eggs are minute, very irregularly arranged and quite numerous, about 200 in each ovisac. Total length 10 to 12 mm. Greatest width (4th segt.) 1.33 mm. Length of ovisacs 7 mm.

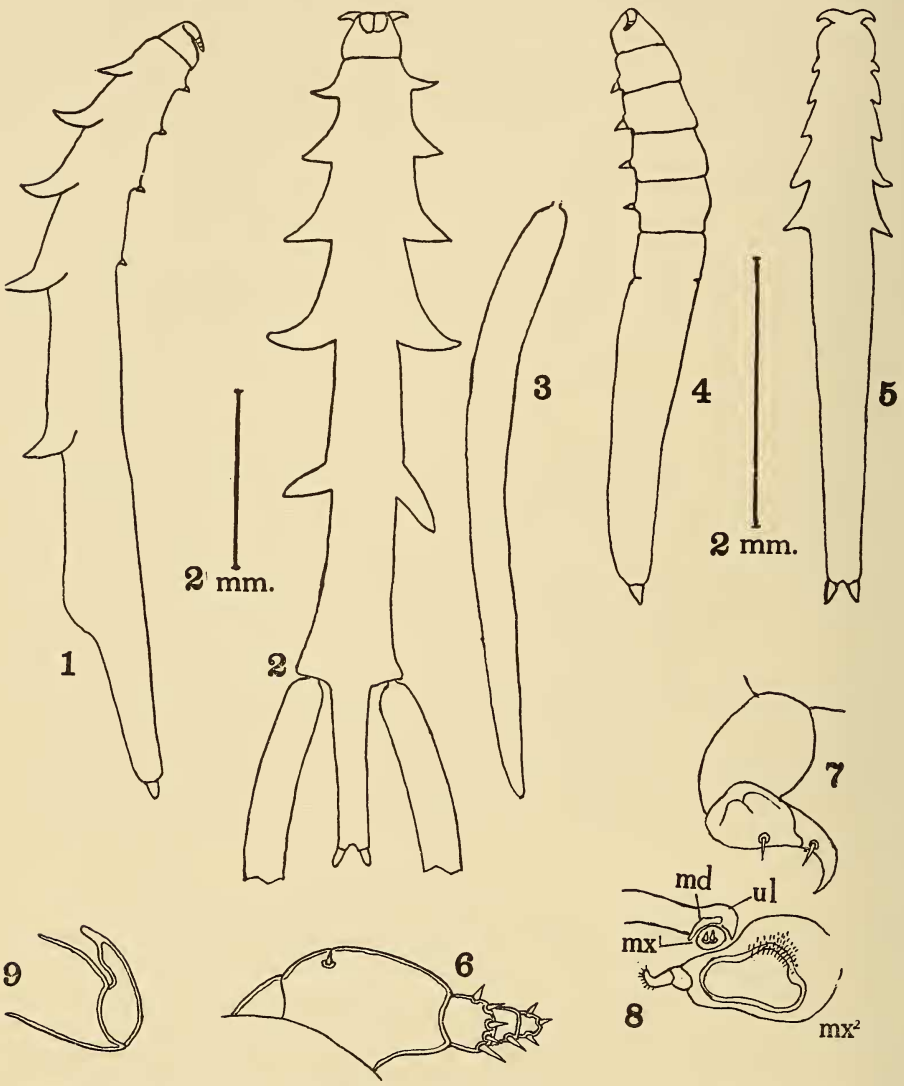
Male.—Considerably smaller than the female, with the thoracic segments more or less separated by grooves. The dorsal processes are considerably reduced in size, the anterior ones almost disappearing, but the legs are relatively larger although they still remain uniramose pointed knobs. The abdomen shows no trace of segmentation; the caudal rami are enlarged and nearly parallel. The mouth parts are similar to those of the female, but there is added to them behind the second maxillae a pair of stout maxillipeds. Total length 4 mm. Greatest width 0.55 mm.

Type.—♂ & ♀, No. 69915 U.S.N.M., from *Ostrea gigas* Thunberg, from Puget Sound.

Remarks.—A new genus and species, *Mytilicola intestinalis*, was established by Steuer in 1903 upon copepods obtained from the edible mussel in the Mediterranean. The same species was reported from the same host by Dollfus in 1914 and 1927 and by Monod & Dollfus in 1932, but no other species of the genus has been proposed up to the present time. That these oyster specimens constitute such a new species can be seen by comparing the swimming legs. In *intestinalis* each leg is biramose and each ramus 2-segmented; in *ostreae* each leg is uniramose and made up of a single segment.

In 1885 Dr. Ramsay Wright described a new genus and species of copepods, *Myicola metisiensis*, found in the common long clam, *Mya arenaria*. In 1914 Dollfus added another new genus and species, *Trochicola enterica*, from certain gastropod mollusks. In 1936 Yamaguti proposed a third new genus and species, *Pseudomyicola ostreae*, from a Japanese oyster, *Ostrea*

denselamellosa. These three are valid genera and with the present genus making a fourth they all agree in having their mouth parts arranged on the general plan found in the Ergasilidae and Bomolochidae. There is an upper



Figs. 1–9.—*Mytilicola ostreae*, n. sp. Fig. 1.—Side view of female. Fig. 2.—Dorsal view of same. Fig. 3.—Ovisac, same magnification as fig. 2. Fig. 4.—Side view of male. Fig. 5.—Dorsal view of same. Fig. 6.—First antenna. Fig. 7.—Second antenna. Fig. 8.—Mouth parts; md, mandible; mx^1, first maxilla; mx^2, second maxilla; ul, upper lip. Fig. 9.—Maxilliped of male.

lip of varying form, beneath whose posterior corners lie a pair of mandibles; behind these are the first maxillae, each consisting of a mamma armed with two or three setae. Then come the second maxillae and in the male the

maxillipeds which are lacking in the female. So complete is this correspondence in all the genera that each mouth part must bear the same name in them all. And when a mouth part is missing those that are present must be named from their position in the general plan and not from their sequence to one another. For example if the mandible is lacking the mamma behind the posterior corners of the upper lip can not be called the mandible although it is the first visible mouth part. Its position tells that it is still the first maxilla.

Since the mandible was lacking in the type species of both *Mytilicola* and *Trochicola* this mamma with its setae was designated as the mandible. This name was changed by Dollfus in later publications for the genus *Trochicola*, and by Monod & Dollfus in 1932 for the genus *Mytilicola*, and this mouth part was correctly named the first maxilla.

It is misleading to designate these copepods as parasites without qualification since that word implies that they feed upon the fluids or the tissues of their host. They should be designated as commensals or at the worst as semiparasites. As can be readily seen from the preceding description the mouth parts are not suited for sucking blood or biting the body tissues of the host. In all probability these copepods subsist by appropriating a portion of the food that would otherwise serve to nourish the oyster. They are not, therefore, definitely harmful, yet their mere presence may not be considered altogether desirable. The fact that they breed prolifically in the ocean instead of in a confined body of water makes it practically impossible to eradicate them. But there is a possibility that they might be banished during the marketing of the oysters.

The digestive fluids connected with the oyster's stomach evidently contain nothing that is injurious to the copepods. Not only do these commensal copepods live and breed there but pelagic species also are often found swimming freely within the stomach. In the present instance a specimen of *Paracalanus* was found in one of the oyster stomachs along with the *Mytilicola* specimens.

Since these copepods are attached to the inner wall of the oyster's stomach even if something could be found that would kill them without injury to the oyster they would remain still attached after death and could be removed only by mechanical means.

Fortunately as stated above there is nothing in the presence of these copepods that is deleterious either to the oysters themselves or to the consumption of them. Recognition of this fact ought to remove any predjudice against their use for food just as it has done in the case of our fish. There is scarcely a single species of food fish that is not more or less infested with parasitic copepods, and these copepods are the genuine parasites feeding on the blood and fluids of the fish. The swordfish is one of those most completely parasitized, both externally and internally; it is safe to say that not a single one of them found in our markets was free from such infection at the time of its

capture. And yet they still remain among the fish commanding the highest market prices and are savory to hundreds of thousands of palates including that of the author. Let the oysters join the fish and exclude all remembrance of the copepods.

ENTOMOLOGY.—*A key to the genera of chiggers (mite larvae of the subfamily Trombiculinae) with descriptions of new genera and species.*[1] H. E. EWING, Bureau of Entomology and Plant Quarantine.

When the present writer began the study of chiggers some years ago only a few species were sufficiently well known to have received names. In the United States only a single species had been named. Today there are known from the New World no less than sixty-five named species and almost as many from the Old World. Because so many species are in this economic group, and particularly because one of them is known to be a transmitter of Kedani fever, a serious disease of man, their study is assuming much importance.

HOST RELATIONSHIPS

The only genera that are here included in the subfamily Trombiculinae are those whose species are believed to have vertebrates as their natural hosts. Although several species have been reported as having both invertebrate and vertebrate hosts, such reports probably are in error. This certainly must be true of a few species with which the writer is familiar. For example, *Trombidium striaticeps* Oudemans which has been reported from both vertebrate and invertebrate hosts, occurs commonly about Washington, D. C., as a parasite of various insects, such as *Musca domestica* and *Stomoxys calcitrans;* yet from the many hundreds of vertebrate hosts from this vicinity examined for chiggers by the writer no specimens of *T. striaticeps* have been taken. In fact, among the many thousands of larvae of Trombiculinae from both North and South America examined by the writer, those of no species have been found to parasitize both invertebrates and vertebrates.

Records of chiggers of a single species from both vertebrate and invertebrate hosts have resulted in most cases, it is believed, either from misidentifications or from finding unattached chiggers wandering over a presumed host, just as they would wander over any other object in their environment. Further observations will eventually enable us to decide whether such species have either vertebrates or

[1] Received March 2, 1938.